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Technological mediation and development of creativity in exploratory mathematical contexts

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Abstract

Creativity is recognized as a fundamental skill in the information society but many countries lack a school model that is able to promote the creative potential of their students.
In mathematics, the development of higher-level skills, such as creativity, is not possible through direct teaching practices. The Digital revolution brought a set of different technological tools with great potential to engineer collaborative work environments and to mediate communication in the classroom.
The main objective of this qualitative is to evaluate the potential of digital technologies to construct collaborative environments and as communication mediation tools and how these dynamics influence the development of creativity and communication in mathematics as well as students' (10-12 years old) digital literacy.
The data obtained by enquiry, direct observation and document collection were subjected to content analysis. Preliminary results seem to indicate that the implementation of these technologies in educational contexts can provide us with opportunities to effectively change the educational paradigm and to develop mathematical and technological skills, both transversal and specific.

Framework

Society faces, today, an unprecedented set of challenges. The creative digital revolution is profoundly changing the way we work, think and "connect", with several implications in our lives (Castells, 2007). The social interactions, now markedly mediated by technology, provide for the creation of units that emerge from the common interests of their users and they are true virtual communities, making connectivity a defining characteristic of the knowledge society (Siemens, 2004). The construction of a collective intelligence, which materializes a large pool of human knowledge, is the mobilizing ideal of this society, where convergence of synergies, expertise and creative ideas encourage collaborative learning based on network interactions (Lévy, 2010).

So, to ensure a sustainable future, educational system needs a strong focus on innovation and on creativity, a crosscutting skill to all areas of knowledge, that has been systematically curtailed by school (Franke, Kazemi, & Battey, 2007; Robinson, 2011). In Math, to successfully face current societal complexity, the prevailing paradigm must evolve – the students should be given really opportunities to autonomously and collaboratively perform challenging and significant tasks and collectively discuss them (Stein, Engle, Smith, & Hughes, 2008). This creative approach, from which knowledge emerges, must be mediated by adequate technologies (Punie, Zinnbauer, & Cabrera, 2006).

Currently a set of tools, software and hardware, with great potential in the educational context, is available. If Microsoft Office 365® (figure 1) provides us with a set of applications and communication services that allow us to construct very powerful collaborative work environments, classroom management applications, such as iTALC (figure 2), can act as useful mediators in the "digital classroom".

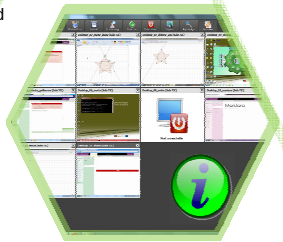

Fig 2 iTALC master interface

Research Question

From this standpoint, we carry out a research oriented by the question:

What is the influence of technology, as communication and mediation tools to solving tasks in collaborative exploratory mathematical contexts, in the development of creativity and other mathematical and technological competences?

Method

Given the purpose of the research, we developed a qualitative case study involving three groups of students in the 6th grade, during the implementation of a set of mathematical exploratory tasks, in class and in non-formal context.

Data were collected through enquiry - survey, questionnaires and interviews; direct observation - supported by field notes and logbook; and documental collection mainly related with Yammer® and Onenote® interactions and tasks' resolutions (see figure 3).

Main results and final remarks

Preliminary results, concerning statistical and content data analysis, suggest improvements on pupil's performance in mathematical and technological skills and dimensions of creativity, like originality, fluency and flexibility.

This study also supports the perception that the creation of network-based collaborative environments and dynamics played a major role in these results. Working in these environments seems to foster student autonomy and motivation levels, particularly in traditionally "hostile" areas, like mathematics.

Fig 1 Microsoft Office 365® cloud services

Fig 3 Documental collection.

Thus, implementing cloud based platforms such as Microsoft Office 365® can contribute to develop a truly collaborative culture, both in students and teachers.

Classroom management software can be a powerful mediation tool during students' ideas presentation and discussions, effectively developing collective constructions of new knowledge.

The use of some digital technologies, like Microsoft KODU® (figure 4) can often re-contextualize mathematical situations to students' own "real-world" and, thereafter, meet their expectations accordingly.

The results also suggest that implementing these technologies in educational contexts can provide excellent ways to develop fundamental digital literacies in students and teachers as well as trigger fundamental changes in the way we understand school, its spaces, the "classroom " and their inherent dynamics. It provide us with an opportunity to really change educational paradigm.

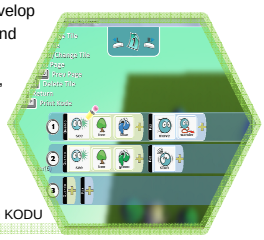

Fig 4 Programming in KODU

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